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Implementation of Lean Manufacturing: A Case Study at ASK Automotive Private Limited (India).

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A B S T R A C T

Lean manufacturing is a known principle used in today's industries to eliminate various hidden wastes that do not add value to the finish product. Lean concept has many advantages which have helped many companies over the years to stay more competitive in global and national business. The purpose of this study is to develop a value stream map for ASK Automotive Private Limited, Manesar in Gurgaon, how information is distributed across the entire company from raw material finished goods suppliers to the customers. This particular tool allows the company to document current lead time, inventory levels and cycle times to determine the ratio of value added to total lead time of the product line being analyzed. Interviews have been conducted with various distribution centre managers, raw material suppliers, and also technicians to familiarize with how things are done currently and the way forward to achieve the aim of operating on lean. Operators and other staffs will be trained to understand how lean works and also the need for continuous improvement and not just a onetime improvement. Recommendations have been made to enable the company to reach the ultimate aim of operating on lean principle which has been known to be helpful.

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Introduction:

Lean manufacturing is a business initiative to reduce waste in manufacturing products. The basic idea is to reduce the cost systematically, throughout the product and production process by means of a series of engineering reviews. Their goal is to satisfy the customer with the exact product, quality, quantity, and price in the shortest amount of time. Lean manufacturing is more than a cost reduction program or a problem solving approaches [7]. The main idea is that an efficient production can be achieved by a comprehensive approach to minimize wastes. This means eliminating excess production and inventory, redundant movement of material, waiting and delays, over processing, excess worker motion, and the need for rework and corrections. Part of lean manufacturing is reviewing operations for those components, processes or products that add cost rather than value [7]. Each step of the manufacturing process is monitored to determine if it adds value to the product. If it does not add value, the process could be delegated to a subcontractor or outsourcing company in order to focus the staff on value-added operations of its core business. A value stream is the set of processes required to transform raw materials into finished goods that customers value [9]. In this study, a value stream map has been developed for ASK automotive private limited in Gurgaon. Creating a value stream map will allow the company to document current production lead time, inventory levels, and cycle times in order to determine the ratio of value-added to total lead time of the product family being analyzed, creating a vision of an ideal

value flow. The goal is to identify and eliminate the wastes in the production process. The company will use these results in order to map the future state and implement lean manufacturing.

A. Research Objectives:

The research has the following objectives:

a) To develop a value stream map and make recommendations for implementation.
b) To minimize the work in process inventory.
c) To meet customer demand on time by eliminating non value added work from the process.
d) To observe and collect information related to product/process flow raw material to finished goods for the value stream selected.

B. Statement of the Problem:

The purpose of this study is to develop a value stream map for ASK Automotive (P) Limited, Manesar in Gurgaon and identify wastes and make recommendations for improvement. It is hoped that the company uses the value stream map for the future implementation of lean manufacturing, in order to increase productivity and improve the quality of goods produced by the company, while at the same time reducing costs, total lead time, human effort, and inventory levels.

C. Importance of the Study:

The value stream map that will result from this study could reduce costs, improve lead time, increase productivity, and improve quality of the products produced by ASK Automotive (P) Limited, Manesar, Gurgaon. The impact of not doing the study could be inefficiency and working with an excess amount of work-in-process inventory which will result in delays on delivery orders, higher operating cost, loss of customers, and less sales revenue.

Literature Review:

During II world war, the economic condition of Japan was heavily destroyed. Due to this there was scarcity of fund resulting in limiting access to corporate finance. In this situation, neither Toyota was able to set up a mass production system like their American counterparts, nor it was possible to layoff the employees to reduce their cost due to legislation [5]. However, Toyota had to devise a new system for reducing costs to sustain in the market. So they decided to produce a small batch of products which would reduce inventories; it means they would need less capital to produce the same product. But this is obstructed by the practical difficulty of changing tools and production lines frequently [6]. To cope with this problem, they started making multipurpose tooling systems in their machines and trained their employees in changeover time reduction methods. At the same time, Toyota realized that investing in people is more important than investing in bigger size machinery and continues employee training throughout the organization. This motivates all employees and they are more open to the improvement process and everyone started giving their input to the company [3].

In this way, short production runs started by Toyota became a benefit rather than a burden, as it was able to respond much more rapidly to changes in demand by quickly switching production from one model to another [1]. Toyota didn't depend on the economies of scale production like American companies. It rather developed a culture, organization and operating system that relentlessly pursued the elimination of waste, variability and inflexibility [10]. To achieve this, it focused its operating system on responding to demand and nothing else. This in turn means it has to be flexible; when there are changes in demand, the operating system is a stable workforce that is required to be much more skilled and much more flexible than those in most mass production systems. Over time, all these elements were consolidated into a new approach to operations that formed the basis of lean or Toyota Production System [5].

Research Methodology:

The procedures for this research have been chosen to meet each of the project objectives. The researcher went through questionnaire, this questionnaire was held short because the research considered about 1000 employees in the factory and the shop floor workers had limited time for participating in the questionnaire survey. The questionnaires consisted of about 28 questions and they took approximately 20 minutes to answer. Before the questions for the survey were created some general methods for how to design questionnaires were studied. A good questionnaire should be easy to understand, clear and uniform, so the selected persons are able and willing to answer it.

A. Data Analysis and Data Collection:

In this research, data analysis was held for both qualitative and quantitative data based on the data collected during interviews held in the company with the managers and engineers of automation projects in machining and assembly and documents gathered from the company. The qualitative analysis is based on the interviews about the automation, challenges, potentials and benefits. The quantitative analysis is performed for identifying some key performance indicators and some elements regarding projects performance.

B. Validity and Reliability:

Validity of a research concerns the accuracy and precision of the gathered data. Also it represents the suitability of the information that has been collected in line with research questions [2]. In this thesis, data are gathered through different methods such as interview, observation, simulation and document study. Almost all the data within the thesis were admitted through more than one method. For instance, information gathered in observation was admitted in interviews by experts.

Value stream mapping of the cells were admitted by engineers and project managers. Also, the sources of data gathering were to somehow the same as sources the case company used for developing projects and daily work. Reliability concerns the credibility of the research methods which has been used and if the research method suits the research topic. Further, reliability depends on how the measuring is performed and how accurate the researcher has been regarding the interpretation and processing of the acquired information [2].

Case Study:

The research is conducted in ASK Automotive (P) Limited whose major products are friction material such as brake assemblies, brake shoe, brake linings, clutch plate and aluminum casting products like panels, hubs, non-automotive parts, crank case, engine parts, grip engine parts etc. ASK automotive has acquired a status of major supplier to original equipment manufacturers (OEMs) in India. They understand the importance of satisfied client base and thus streamline their processes to provide 100 percent customer-oriented satisfaction to their clients with unmatched quality. With its motto of 'Customer First' the company has grown over the years and presently it has 8 business units at different locations. The factory consists of friction material, pressure die casting, paint shop and finishing assemblies section. Generally, operators are responsible for the quality of individual work, even after that there is quality check at the end of each section or department so that there should not be any defective parts transferred from one section to another section.

A. Conducting time study:

To calculate standard time for each operation, time study is conducted in the shop floor. To do this, at least two operators were selected for each operation so that the difference in timing can be cross checked from the observed data of these two operators. To get better results, each operation time is taken for at least any cycles. Once time study is made by collecting raw data the performance rating is given to each operator and actual time is calculated for particular operation.

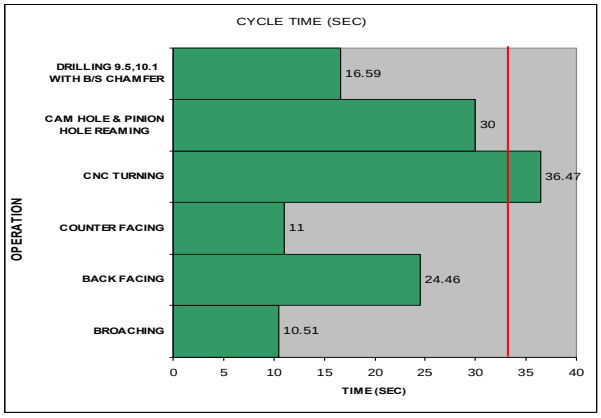

Fig. 1: Cycle time for different machine operations

Cycle time is time taken to do one repetition of any particular task typically measured from the starting point of one product's processing in a specified machine or operation until the start of another similar product's processing in the same machine or process. The cycle time the brake panel has been reduced by 21 seconds (i.e. approximately 42%). This has been achieved by combining six operations (Drilling 9.5,10.1 with B/s chamfer, cam hole and pinion hole reaming, CNC turning, counter facing, back facing and broaching) with the other operations. The time needed to complete the work on different machine in seconds is shown in Fig. 1 and the time takt time for each and every operation is 34.32 seconds. Second data below Fig. 2 clearly shows how many operators are working under each operation, to reduce production time and eliminates also waste due to operator waiting time.

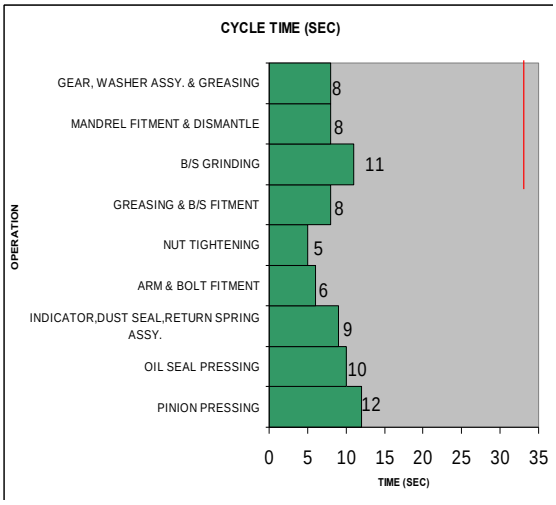

Fig. 2: Cycle time for different minor operations

B. Current stream map:

The current stream map is a method of lean manufacturing which uses symbols, metrics and arrows to show and improve the flow of inventory and information required to produce a product or service which is delivered to a consumer. This current stream map are utilised to assess current manufacturing processes, visual representation which enables one to determine where the waste occurs and create ideal and future state processes. This helps in identifying and eliminating waste, thereby implementing lean principles. After identifying the non value added steps in the current state, a future state value stream map is developed. Current raw material inventory which carries two times daily inventory and child part which is turned into a casting stock of daily needs of casting supplier. This has been possible because of arrangement made between suppliers and the company where the supplier delivers goods on daily basis. Suppliers are ready to deliver on daily basis and if by any reason delivery can't be done on a particular day, the company will be notice through email before close of midday for the company to pick the goods up to avoid stops of productions. Daily delivery of goods from the company

to customers and distribution centers is still done on daily basis but with much improvement on how orders can be placed so that the delivery can be done as expected by customers. Production information is written on a notice board placed at a place for everybody to be able to read so that operators will know how much they are to produce within a shift and work according to that information.

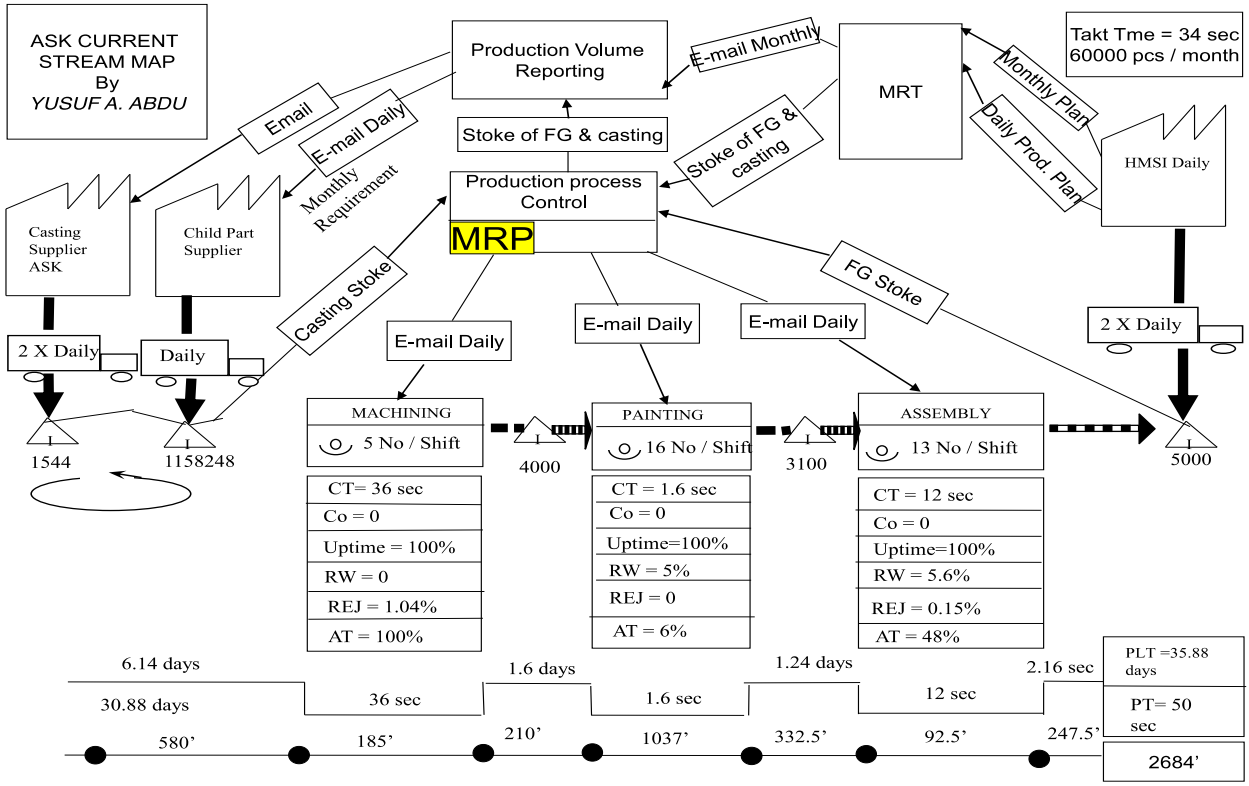

Fig. 3: Current Stream Map

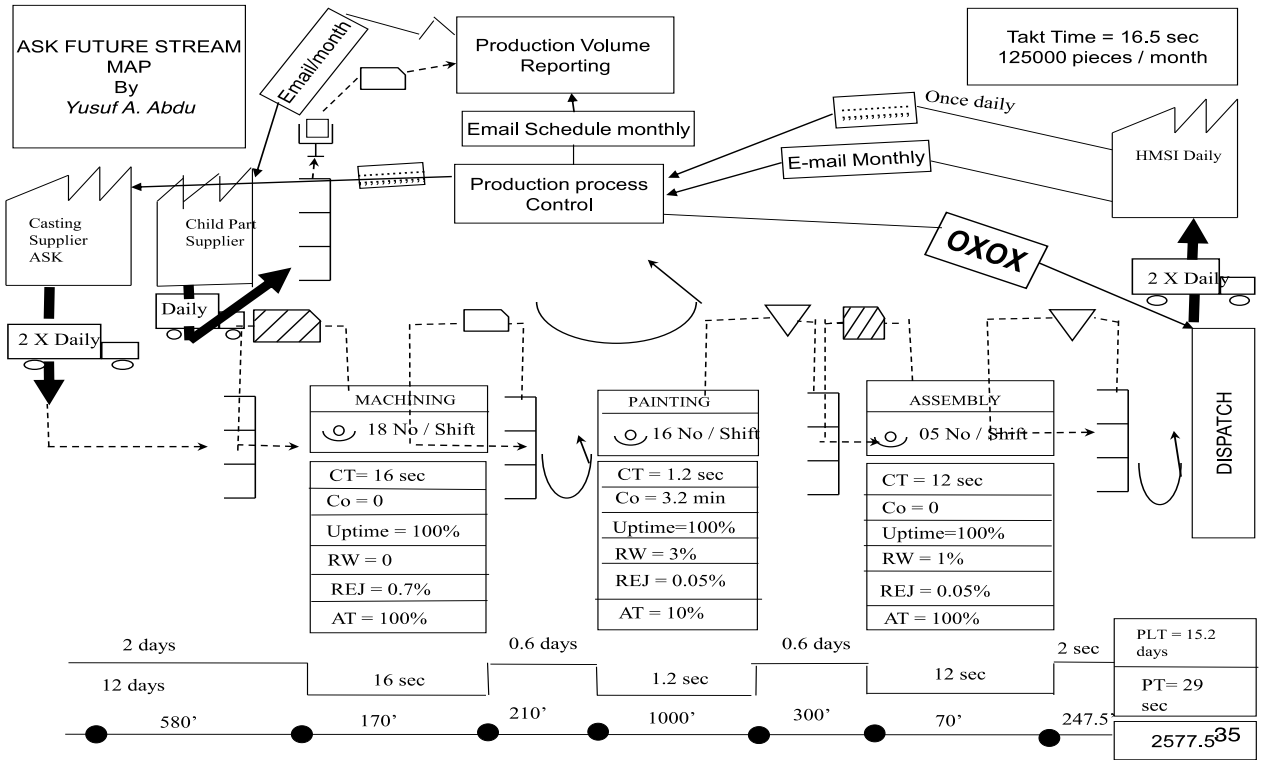

Fig. 4: Future Stream Map

C. Future Stream Map:

The future state value stream map often represents a significant change compared to the way the company currently operates. The future state value stream mapping shows all the suggested processes with the machining operation will pull raw materials from the casting stock applying first-in- first-out principles. The next operation is machining operation (broaching machine, CNC machine, drilling machine and counter facing etc.) with eight operators running all this type of processes. This has been successful because these processes are interrelated and they do not require much supervision also. Grouping them also helps to reduce the total cycle time for the three processes to 16 seconds which is the maximum required among them. This has contributed to reduce the total value adding time which is very significant. The customer requirement is 125000 pieces per month. The takt time for the demand of 125000 pieces is 16.5 seconds and the daily requirement is 4808 pieces per day. Re-design the value stream map and look back at the new layout to evaluate and verify the efficiency of the solutions. The Fig. 4 shows a new value stream map at ASK automotive private limited. This table shows the results that the production lead time is reduced dramatically from 35.88 days to 14 days for the whole operation. Also information between distribution centers and the company and placing of orders is advised to be done through email which is cheaper and reliable to avoid error in processing orders. Production information is written on a notice board placed at a place for everybody to be able to read so that operators will all know how much they are to produce within a shift and work according to that information

Result:

A. Calculations:

a) Lead time (LT):

- For Current Stream Map

(Lead time)C = Reduce inventory time + WIP (M/c) + WIP (painting) + Inventory FG

= 30.88 days + 1.6 days + 1.24 days + 2.16 days

= 35.88 days

- For Future Stream Map

(Lead time)F = 12 days + 0.6 days + 2 days

= 15.4 days

But the Percentage Improvement can be calculated by

$$\%\text{ age Improvement} = 100\% - \frac{(LT)f}{(LT)c}\, x 100\ \%\text{-----(1)}$$

$$= 100\ \% - \frac{15.4\ \text{days}}{35.88\ \text{days}}\, x\ 100\ \%$$

= 57.6 %

b) WIP:

- For Current Stream Map

(WIP)C = WIP (M/c) + WIP (painting)

= 1.6 days + 1.24 days

= 2.84 days

- For Future Stream Map

(WIP)F = 0.6 days + 0.6 days

= 1.2 days

The Percentage Improvement can be calculated by

$$\%\text{age Improvement} = 100\% - \frac{(WIP)f}{(WIP)c}\, x\ 100\%\text{---(2)}$$

$$= 100\ \% - \frac{1.2\ \text{days}}{2.84\ \text{days}}\, x\ 100\ \%$$

= 57 %

c) Manpower (MP):

- For Current Stream Map

(Manpower)c = No. of operators in M/c + No. of operators in painting + No. of operators in assembly

= 5 + 16 + 13

= 34

- For Future Stream Map

(Manpower)F = 8 + 16 + 5

= 29

The Percentage Improvement can be calculated by

$$\%\text{ age Improvement} = 100\% - \frac{(MP)f}{(MP)c}\, x\ 100\ \%\text{----(3)}$$

$$= 100\ \% - \frac{29}{34}\, x\ 100\ \%$$

= 14.7 %

d) Rejection/Rework % age:

- For Current Stream Map

(Rejection/Rework % age)C = (REJ) in M/c + (RW) in Painting + (REJ) in assembly + (RW) in assembly

= 1.04 % + 5 % + 0.15 % + 5.6 %

= 11.79 %

- For Future Stream Map

(Rejection/Rework % age)F = 0.7 % + 3 % + 0.05 % + 1 % + 0.05 %

= 4.8 %

The Percentage Improvement can be calculated by

$$\%\text{ age Improvement} = 100\ \% - \frac{(\text{Rejection\_Rework \% age})f}{(\text{Rejection\_Rework \% age})c}\, x\ 100\ \%\text{----------(4)}$$

$$= 100\ \% - \frac{4.8}{11.79}\, x\ 100\ \%$$

= 59 %

B. Improvement Areas:

Waste reduction is the major concern in the today's manufacturing company. The below table 1 states that Lead time, Rejection/Rework, WIP and unnecessary motion are major waste that affect the production in the manufacturing company.

Table: 1. Improvement Areas

Area	Current State	Future State	% age Improvement
Lead Time	35.88 DAYS	14 DAYS	61%
WIP	2.84 DAYS	1.2 DAYS	57%
Manpower	34	25	26%
Inventory FG	2.16 DAYS	2 DAYS	7 %
Rejection/Rework % age	11.79%	4.8%	59%
Processing Time Reduction	50 Sec	29 Sec	42%
Material Movement	2684.5 FT	2577.5 FT	4 %

The other major waste that is inventory waste, over processing waste, over production waste, defect waste is not considered as the major waste. These are the majority of the percentage of improvement areas when compared with the current and future state.

C. Operator Skill Improvement:

There is rare chance for operators to do multiple jobs; they do multiple jobs only in critical situations so they don't have much knowledge of another job. They may work more efficiently on the job they were trained but have lack of knowledge for other jobs in the same production line. Whereas in case of all operators should have to learn at least three to four operations to balance the cell. This is achieved by rotating operators in between machines for the smooth flow of pieces.

D. Operator Motivation:

Operators are motivated because all operators are working in multiple operations in rotation. So there is no arguing that someone is doing a difficult operation and others are working in easier operations. On the other hand, this is not possible in batch production because of specific allocated work for the whole day. Similarly, in case of new layout, operators are treated as a group inside the cell so their combined effort is to do better and produce more. Likewise, operators cannot work carelessly because they will be immediately caught by the next operator inside the cell, so the combined result of all these factors motivates them to do better in each step.

E. Comparison of Information Flow

The existing production line is very long, starting from preparatory to the end of assembly. Because of this, communication and information flow is difficult and for each and every thing supervisor has to walk around the line frequently. The new information flow is effective and quick. Because, the group of people who are in the same cell, works in compact area where each operator is in direct contact with other operator of the cell and they know each other's job inside the cell. This makes information flow fast and accurate. Whereas this cannot be achieved in long assembly line; where one operator is in contact with only two operators (one operator before and one operator after his operation) so neither he can give any suggestion nor he knows the issues of other operation i.e. workers are not participating in each other's work, rather working independently.

Conclusion:

The aim of this research was to develop a value stream map best suitable for manufacturing process of brake panel by eliminating any kind of waste. The research was achieved by converting sitting operation to standing operation and by converting long assembly line into small work cells. Thus by converting long assembly line into work cells, the assumed worker multi-skilling seems effective as well as communication between operators is fast and accurate. The other benefits observed are the flexibility of style changeover and rework reduction. Thus the initial assumptions were solved by this study in the case company.

After the current state has been completed, percent value added, the processing time that the customer is willing to pay for, can be calculated as the ratio of the total lead time to value added processing time. From the current state, problems in the process are identified and goals for improvement are identified and placed on the future state map. Value Stream Maps can be used in order to visualize and make improvements on a process; this is done through a future state map of the process, which represents the ideal situation of the process.

Future Scope:

In this research, only the brake panel manufacturing operations are standardized. But this work can be extended in assembly plant also. The idea of cellular manufacturing may be implementing in assembly plant is to increase the productivity. This can be further improved by using the system of group incentive and reward systems. Similarly, the sitting operations have been converted into standing operations for the better movement of operators in between the machines, from the perspective of work balancing and uniform work load distribution. But it is necessary to understand whether this standing operation is appropriate from the ergonomic point of view or not. Because, if there is any short or long term there is possibility of health problem in standing operation. So this issue needs to be reviewed some other way also, rather than productivity point of view only. So the research can be extended to the other areas of the industries also. This will minimize the duplication of work and it is easier to calculate standard time of new style by reallocation of some operations over existing

References:

1. Arunagiri P., A. Gnanavelbabu, Implementation of Lean Manufacturing System in Bogie Assembly in Railway Coach Factory, Applied Mechanics and Materials, vol. 248, pp. 511-515 (2013).
2. Bryman, A. and Bell, E. 2007, business research methods, Oxford University press, Oxford University.

3. Feld, W. (2000). Lean manufacturing: Tools, techniques, and how to use them. Boca Raton, FL: St. Lucie Press.
4. http://engg1ali.blogspot.com.ng/2013/09/lean-manufacturing.html. Accessed on June, 2015.
5. M.Sugadeva Boopathi, S.Sendhil kumar "Implementing of Lean Tool in Garment Industry: A Review" International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4(3), pp. 55-60, (2015).
6. Paneru N. (2011) "Implementation of Lean Manufacturing Tools in Garment Manufacturing Process Focusing Sewing Section of Men's Shirt" Master Thesis, Oulu University of Applied Sciences, Finland.
7. Tapping, D., Luyster, T., & Shuker, T. (2002). Value stream management: steps to planning, mapping, and sustaining lean improvements. New York, NY: Productivity Press.
8. Wilson, L. (2009). How to Implement Lean Manufacturing. New York: McGraw-Hill Professional Publishing. p. 29- 214.
9. Womack, J., & Jones, D. (1996). Lean thinking: Banish waste and create wealth in your corporation. New York, NY: Simon & Schuster.
10. www.textiletools.blogspot.com.ng/2016/02/implementation-of-lean-manufacturing.html. Accessed on February, 2016.